

**AIR QUALITY CONFORMITY
FOR THE CINCINNATI
NONATTAINMENT REGION**

**TRANSPORTATION IMPROVEMENT PROGRAM
FY 1997-2000**

JUNE 1996

Ohio-Kentucky-Indiana Regional Council of Governments
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ABSTRACT

TITLE: AIR QUALITY CONFORMITY FOR FISCAL YEARS 1997-2000
TRANSPORTATION IMPROVEMENT PROGRAM FOR THE
CINCINNATI NONATTAINMENT REGION

DATE: June 1996

AGENCY: The Ohio-Kentucky-Indiana Regional Council of Governments is
the regional planning organization for the eight county tri-state
area of Greater Cincinnati. OKI works on a variety of regional
issues related to transportation planning, commuter services and
environmental quality. Executive Director: James Q. Duane

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ABSTRACT: The Clean Air Act Amendments (CAAA) of 1990 require
emissions reductions in nonattainment areas. The CAAA contains
conformity provisions requiring transportation plans and programs
to conform to air quality plans. Based on the documented
analysis, the OKI Fiscal Years 1997-2000 Transportation
Improvement Program meets the air quality conformity
requirements.

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INTRODUCTION

The Clean Air Act Amendments (CAAA) of 1990 require substantial emissions reductions from mobile sources, i.e. autos, trucks, buses, etc. for some urban areas. To ensure achievement of these reductions, the CAAA contains conformity provisions requiring transportation plans and programs in nonattainment areas to conform to air quality plans. Without conformity, federal funds for highway and transit projects could be withheld because projects may prove detrimental to air quality.

The U.S. Department of Transportation (USDOT) and U.S. Environmental Protection Agency (USEPA) have jointly prepared regulations interpreting the CAAA conformity provisions. These regulations provide criteria and procedures to be followed by Metropolitan Planning Organizations (MPOs) in making conformity determinations regarding Transportation Improvement Programs (TIPs) and Transportation Plans (Long Range Plan or Plan) with air quality plans (State Implementation Plans or SIPs). *Criteria and Procedures for Determining Conformity to State or Federal Implementation Plans of Transportation Plans, Programs and Projects Funded or Approved Under Title 23 U.S.C. or the Federal Transit Act* were issued on November 24, 1993.

Purpose

The purpose of this document is to demonstrate that Fiscal Years 1997-2000 Transportation Improvement Program developed by OKI is in conformity with Section 176(c)(3) of the 1990 Clean Air Act Amendments. This determination is prepared in adherence with the Federal Conformity Regulations. Methodologies and results of the TIP conformity determination are presented herein.

The Greater Cincinnati region has been classified as a "moderate" non-attainment area for ozone by the USEPA. Ozone is not directly emitted, but is formed when precursor emissions, volatile organic compounds (VOC) and nitrogen oxides (NOx) react in the presence of sunlight. VOC and NOx emissions are the focus of this document.

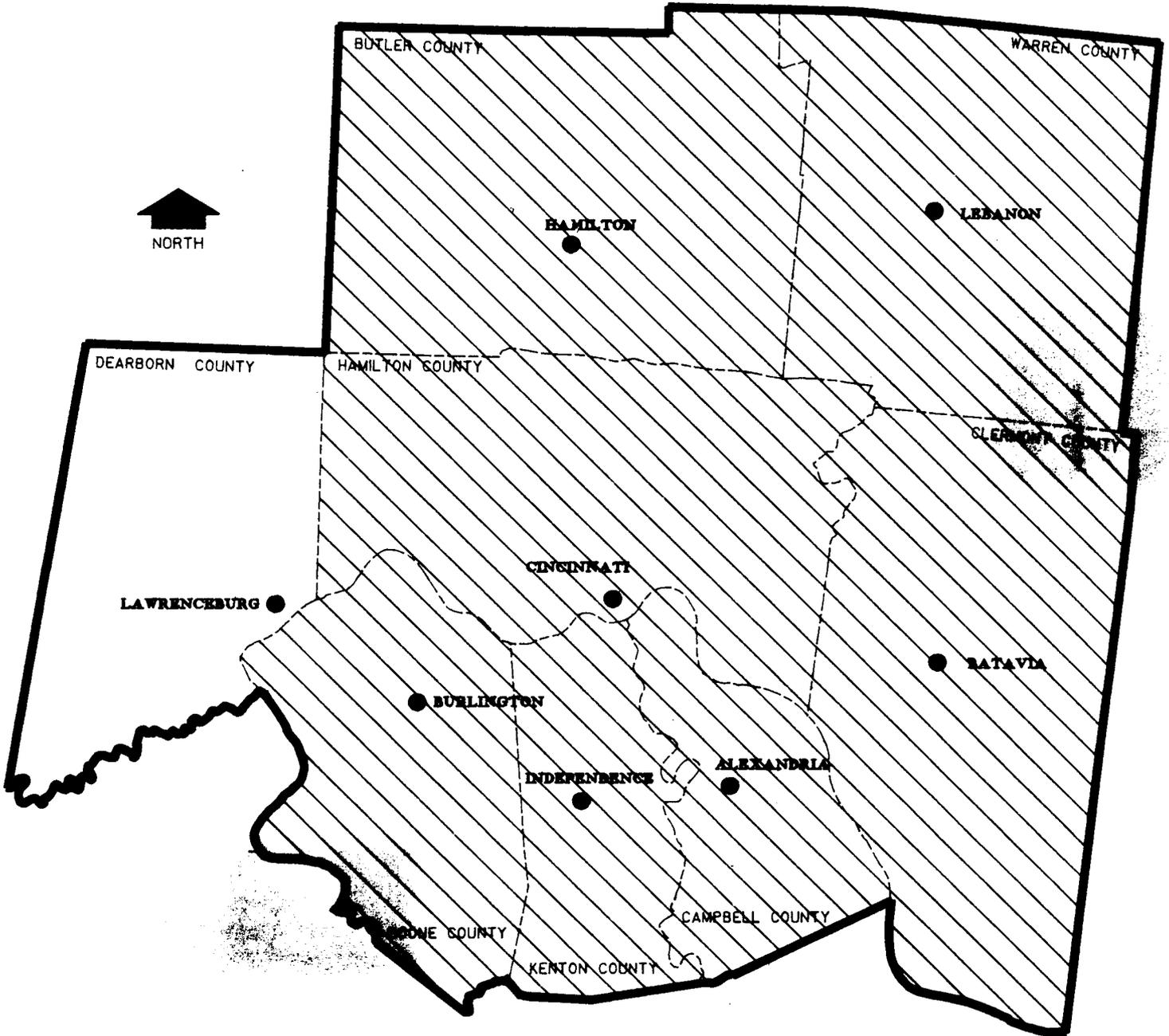
OKI Planning Area

OKI's planning jurisdiction contains eight counties in three states. The counties within the OKI region which have been classified as nonattainment for ozone are: Butler, Clermont, Hamilton, and Warren Counties in Southwest Ohio, and Boone, Campbell, and Kenton Counties in Northern Kentucky. Dearborn County, Indiana has been designated unclassifiable/attainment and thus is not included in this analysis. The nonattainment region is shown in Figure 1.

CONFORMITY CRITERIA

Ohio-Kentucky-Indiana Regional Council of Governments (OKI) is the MPO for the Greater Cincinnati area responsible for transportation planning. OKI demonstrated conformity of the

Figure 1
OKI REGION



OKI Ohio • Kentucky • Indiana
Regional Council of Governments

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1995-1998 and 1996-1999 TIPs and the Financially Constrained Transportation Plan under the Federal Conformity Regulations. The same process is used to demonstrate conformity on Fiscal Years 1997-2000 Transportation Improvement Program. This process is also in accordance with the *Ohio State Transportation Conformity Rules* issued August 21, 1995 by Ohio EPA; however, these rules have not yet been approved by USEPA.

Consultation Procedures

The appropriate consultation procedures were followed including a Public Involvement meeting held June 18 and comments. The status and description of roadway projects were defined in consultation with the Ohio Department of Transportation (ODOT), Kentucky Transportation Cabinet and when applicable the Ohio county engineers. The selection of appropriate conformity tests and modelling assumptions was developed with consultation with the Ohio EPA, ODOT, Kentucky Natural Resources and Environmental Protection Cabinet and Kentucky Transportation Cabinet.

Air Quality Plans

The 15% Rate of Progress SIPs were submitted to USEPA on November 12, 1993 for the Northern Kentucky counties and on March 14, 1994 for the Southwest Ohio counties. The motor vehicle emission budgets were revised by the Ohio and Kentucky Maintenance Plans submitted with the Redesignation Requests in November 1994. The Commonwealth of Kentucky later revised their Maintenance Plan in April 1994 and requested withdrawal of their 15% Plan on June 29, 1995. Exemption from the nitrogen oxides (NO_x) requirements as provided for in Section 182(f) of CAAA was also requested during the same period as the original Redesignation Requests.

USEPA has proposed approval of the Redesignation Request for Cincinnati area Ohio counties in the Federal Register dated May 5, 1995. Since the region experienced an ozone standard violation in July 1995, USEPA has proposed disapproval of the Redesignation Request for Northern Kentucky in the Federal Register dated April 18, 1996. Final action on the NO_x exemption for transportation conformity for Southwestern Ohio has been delayed per the Federal Register dated July 13, 1995. EPA proposed to approve an exemption of the general conformity requirements for Northern Kentucky in Federal Register dated May 10, 1995; however, this approval was contingent on continued maintenance of the ozone standard. The other plans and requests have not been fully approved by USEPA, although all have completed the public review process.

The 15% Plan is the most recent applicable Ohio SIP submittal, thus it is the air quality plan in this conformity demonstration. The 15% Plan determines the VOC budget for the Ohio counties. Emissions for the full region will be used in the BASELINE/ACTION comparisons and less than 1990 test as required by Phase II of the Interim Period (Kentucky) and Transitional Period (Ohio) for transportation conformity. The respective SIPs contain the 1990 mobile source inventories. The Ohio 1990 base-year emissions inventories were approved per the

Federal Register dated December 7, 1995. No action has been taken by EPA on the Kentucky 1990 base-year emissions inventories.

Conformity Tests

To demonstrate conformity with air quality requirements, the VOC and NO_x emissions for a transportation system with the TIP/Plan projects (ACTION scenario) must be less than that for a transportation system without the TIP projects (BASELINE scenario) for each of the analysis years. Additionally, it is required that the emissions for all ACTION scenarios be less than the 1990 base year emissions. The 1997-2000 TIP is analyzed for the years of 1997, 2005 and 2010. The horizon year of the Plan is 2010. All projects currently in the TIP are assumed to be in-place by 2005. The emissions from the Ohio and Kentucky counties are combined for all tests, excluding the 15% SIP VOC budget test which is for the Ohio portion only.

Transportation Control Measures

The OKI 1997-2000 TIP provides for timely implementation of Transportation Control Measures in the applicable SIPs. For purposes of this conformity determination, Reformulated Gasoline (RFG) is assumed for the Kentucky counties. RFG was implemented in January 1995. No other mobile source controls are assumed and no SIP is in-effect for Northern Kentucky.

In all affected Ohio counties, enhanced inspection and maintenance (I/M) program is assumed to begin January 1995 and stage II vapor recovery is assumed to begin in 1993 with a two year phase-in period. This timing is consistent with the assumptions used in development of the Ohio 15% SIP. Enhanced I/M began in January 1996. The completion of stage II vapor recovery in the Ohio counties has been extended until May 31, 1996. Implementation delays were not induced by past or present TIPs or Plans. No other transportation control measures are contained in the Ohio SIP for Greater Cincinnati.

Latest Planning Assumptions

The 1997-2000 TIP is consistent with the OKI Long Range Transportation Plan as amended for financial constraint on April 13, 1995. The modeling process used to develop the Plan was calibrated using the latest demographic and land use data available, and validated with recent traffic counts. The demographic data was based on the 1990 Census and projections from the Ohio Department of Development and Kentucky State Data Center. The analysis methodology and assumptions used are consistent with those used in conformity analysis of the 1995-1998 and 1997-2000 TIPs and the amended Plan, except when noted.

USDOT has suggested that the vehicle miles traveled (VMT) projected growth from the Travel Demand Model be compared to the historical Highway Performance Monitoring System (HPMS) VMT growth. This comparison might provide an additional means of assuring that the urban travel demand model is producing accurate results. However, the annual HPMS VMT growth has tremendous fluctuations, and ODOT does not have confidence that a comparison

is meaningful. ODOT believes that the urban transportation models are therefore the best information available concerning urbanized area VMT growth.

CONFORMITY METHODOLOGY

To determine the emissions, the OKI Travel Demand Model is used to estimate the traffic volume on each roadway segment, USEPA's MOBILE5A determines the emission rates and an OKI utility program (IMPACT2) calculates the loaded speed, VMT and emissions for each roadway segment. The complete model was run twice for each analysis year, once for the BASELINE network and again for the ACTION network.

Full documentation describing the OKI models function, operation and validation is available in the "OKI Travel Demand Model User's Guide: Model Version V0" dated March 15, 1984 and "OKI Travel Forecasting Model: Methodology and Validation" dated March 2, 1995. Each of the models is briefly described below.

OKI Travel Demand Model

The OKI Travel Demand Model is a computerized travel demand forecasting model for the entire Cincinnati nonattainment area. The model uses a traditional four phase sequential travel demand forecasting process of trip generation, distribution, modal choice and assignment. The modeling process projects VMT growth and changes in regional travel patterns. The OKI Travel Demand Model is composed of TRANPLAN programs and Fortran programs written by OKI.

The model takes demographic and land use data for each traffic zone and the transportation network as inputs, and produces estimated traffic volumes on each roadway segment in the network. Traffic zones are the analysis units in the model. The OKI region is divided into 909 zones. The output of the model is a loaded highway network which contains information for each link such as initial speed, capacity, distance, functional class, district number, area type and forecasted traffic volume.

Transportation Network

All regionally significant projects regardless of the funding source are evaluated for their impacts on the air quality in the nonattainment area as required by USEPA and USDOT. The 1990 base year inventory was created using the facilities that were in-place in 1990. Four additional transportation networks were utilized for the 1997-2000 TIP analysis.

The BASELINE network includes all in-place facilities, ongoing travel demand management activities, and all capacity-related projects that are currently under construction. Federal Conformity Regulations also specify projects which are not yet constructed but have cleared the environmental review as called for under the National Environmental Protection Act (NEPA) to be included in the BASELINE network. Capacity-related projects are those that contribute additional speed or capacity to the system in the form of additional lanes or new roads. The

BASELINE transit network is the 1990 transit (bus) network with fares indexed for projected inflation.

The 1997 ACTION roadway network includes the BASELINE network plus capacity-related projects in OKI's 1997-2000 TIP that are expected to be completed by the analysis year. The ACTION network for 2005 as shown in Figure 2 includes the BASELINE network plus all capacity-related projects in OKI's 1997-2000 TIP. No additional Plan projects are included in the 2005 network, since none are expected to be complete by 2005. The 2010 ACTION network includes the BASELINE plus all capacity-related projects in OKI's 1997-2000 TIP and Transportation Plan (as amended in April 1995). The transit network for 2010 ACTION scenario is an expanded bus network and the rail alignments shown in Figure 3. Plan roadway projects are shown in Figure 4 and listed in Appendix A.

The listing of TIP projects by state indicates under the "AQ Conformity" column whether the project was analyzed for 1997 or analyzed for 2005. All projects are analyzed for 2010. For purposes of identification, those projects that have passed the environmental review process and are included in the BASELINE network also carry the note "NEPA" in the "AQ Conformity" column. The BASELINE network projects and changes are shown in Appendix B and the TIP projects in the ACTION networks are detailed in Appendix C.

Demographic Data

Complete sets of demographic data were prepared for 1990 and 2010. This data was prepared from the 1990 census and used in development of the Long Range Regional Transportation Plan (originally adopted in November 1993). For the intermediate years of 1997 and 2005 interpolation between 1990 and 2010 was performed.

Emission Factor Model

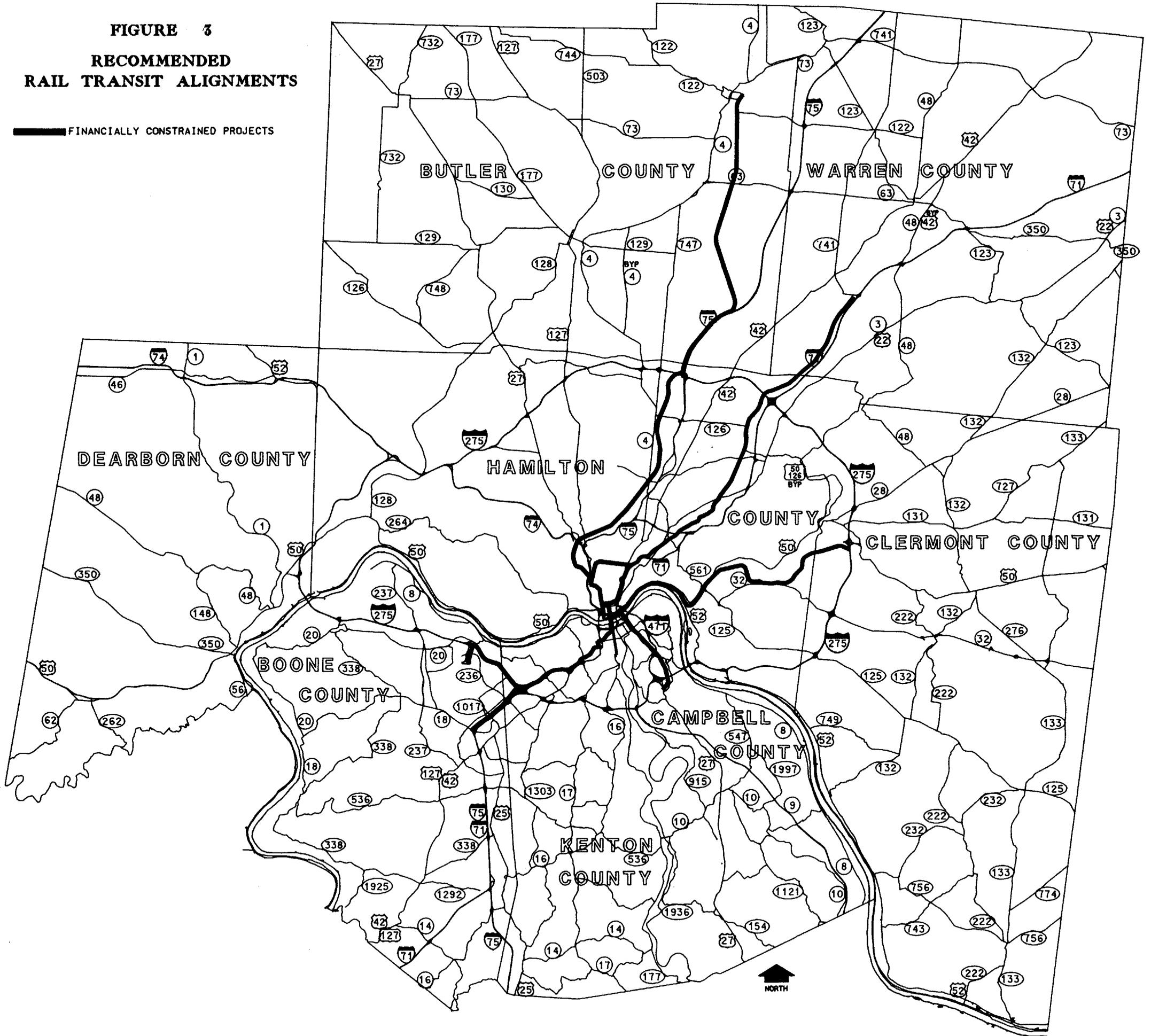
The Final Conformity Regulations require the use of the most recent emission factor calculation technique. The version of MOBILE5a, released by USEPA and dated April 22, 1993, was used in the analyses. MOBILE 5a_H was not used, since no emission credits are taken for technician training and a retest-based hybrid I/M program is not applicable.

Emission factors are generated for speeds between 5 mph and 65 mph at 1.0 mph intervals for various vehicle types. These rates have units of grams per VMT. Roadways are grouped by area type and functional classification. Specific local or state data was used to calculate the emission rates when possible. This more detailed data allows for emissions estimates for each hour of the day on a link by link basis. When local data were unavailable or unknown, defaults contained in the model were used. Ohio and Kentucky emissions are handled separately due to the differences in emission control strategies adopted by each state.

The MOBILE5A input files are contained in Appendix D as well as complete tables for hourly temperatures and for the following factors by roadway type: hourly hot/cold start percentages,

FIGURE 3
RECOMMENDED
RAIL TRANSIT ALIGNMENTS

— FINANCIALLY CONSTRAINED PROJECTS



hourly vehicle mix, hourly traffic distribution, hourly directional split factors, summer factors and loaded speed. These inputs are consistent with the 1995-1998 and 1996-1999 TIP analyses. The Ohio MOBILE5A flag files are consistent with those used in determination of the 15% Plan budget, and the Kentucky flag files are consistent with the current status of emission control strategies (RFG) in this part of the region. The input data used in the analysis are discussed below.

Temperature

The MOBILE5A Emissions Factor Model calculates emissions from several sources within a vehicle while it is operating and not operating. The rate of the release of pollutants is strongly a function of temperature. Estimated hourly temperatures are incorporated based on several years of observed Ohio metropolitan areas' meteorological data calculated by ODOT. The temperatures reflect average July temperatures, which is generally the worst case scenario for ozone formation.

Emission Control Programs

The 1990 base year is modeled with five of the seven regional counties operating a visual inspection anti-tampering program (ATP). The anti-tampering program is replaced with a more stringent I/M program in 1996 that will include all of the Ohio ozone nonattainment counties. The Ohio counties have an I/M program that includes the loaded idle test, transient (IM240) test, ATP, and pressure and purge tests. No I/M or ATP is assumed for the Kentucky counties after 1990. In the Ohio counties, new evaporative emission controls are assumed to be phased-in starting with the 1996 model year, which is consistent with MOBILE5A default values.

Vapor Recovery

Stage II vapor recovery is assumed to have started in 1993 in the Ohio counties with a two year phase-in period and a 86% efficiency for all vehicle classes. On-board vapor recovery systems are assumed to begin in 1995 for Ohio counties consistent with the 15% Plan.

Clean Fuels

The market share for oxygenated fuels in Ohio was obtained from the Ohio Department of Taxation's monthly Motor Fuel Tax.

Fuel Volatility

Fuel volatility mainly effects evaporative emissions. The volatility is mandated by the CAAA to be reduced to 9.0 Reid Vapor Pressure (RVP) by 1992. The volatility is not expected to change after 1992 in the region.

Hot/Cold Start Percentages

The default hot/cold start operating mode fractions provided in the MOBILE5A program are the same for all hours of the day, but the percentage of cold starts vary throughout the day and depending on the roadway type. These variations are reflected in OKI's emission levels by applying freeway and surface street hot/cold start percentage data for each hour as provided by ODOT. The ODOT data was derived from "Determination of Percentages of Vehicles

Operating in the Cold Start Mode”, EPA-450/3-77-023, Office of Air and Waste Management, Office of Air Quality Planning Standards, Research Triangle Park, North Carolina, 27711.

Vehicle Mix

Data from ODOT has also been incorporated to simulate freeway and non-freeway vehicle mix for each hour of the day. The vehicle mixes were developed using Ohio state-wide classification traffic counts over several years by ODOT Bureau of Technical Services.

Model Defaults and Options

Default parameters provided within the model were utilized when no more specific data was available. The options and default values supplied within MOBILE5A that were used are:

- Default tampering rates;
- The specification that all vehicle types are traveling at the same speed;
- The default VMT mix accumulation rate;
- The default mileage accumulation rate by vehicle age and registration distribution;
- The basic exhaust emission rates;
- No adjustments to the emission rates for humidity, extra loading, trailer towing or air conditioning usage;
- Low altitude emissions;
- Emission rates for VOC, carbon monoxide (CO) and NO_x were calculated using the scenario day of July 1 of each analysis year.

Data Processing

The output of the OKI Travel Demand Model was input to the OKI utility postprocessing program, IMPACT2. IMPACT2 uses the emission factors generated by MOBILE5A and the loaded highway network link volumes and distances to calculate emission levels for each link for each hour of the day. The program also performs the appropriate summation by area and roadway type as well as regional totals.

Speed

Vehicular speed is a very important variable in the calculation of emissions from mobile sources. A speed - volume to capacity ratio table for various roadway functional classes assigns directional loaded speeds based on the level of congestion. This table provided by ODOT incorporates the 1994 Highway Capacity Manual specifically to adjust freeway speeds more accurately. Loaded speeds are designed to be reflective of conditions based on assignment link volumes and capacities.

Traffic Distribution and Directional Split Factors

OKI has developed hourly traffic distribution and directional split factors for different roadway types. The main source of the data was the permanent traffic counting stations located throughout the OKI region for the years of 1988-1990. This data was supplemented with data collected at coverage count stations (locations with counts taken on only 1-2 days) with

directional and hourly breakdowns during the same period. The stations were classified by functional classification and area type as follows: urban freeway, rural freeway, urban arterial, rural arterial, urban collector and rural collector.

The percent average daily traffic (ADT) for each hour and each direction from each station was averaged to obtain an ADT percentage for each classification. The volume for each hour and each direction was also averaged to obtain an average volume for each classification. Ratios were calculated by dividing the average volume for each hour in the peak volume direction by the total average volume for each hour in both directions.

Seasonal Factors

OKI has developed seasonal conversion factors to adjust traffic volumes to summer conditions. The hourly volumes are multiplied by the corresponding seasonal factor. Six categories represent different area type and functional classifications. The factors were derived from local data collected at permanent traffic counting stations during 1988 - 1990 utilizing the ADT monthly conversion factors for June, July and August.

CONFORMITY FINDINGS

The results of the analyses have been summarized in the following tables. Table I provides a comparison between the ACTION scenario emissions and the 1990 base year, and BASELINE levels for each of the analysis years. Only VOC and NOx emissions from the Kentucky counties of Boone, Campbell and Kenton and the Ohio counties of Butler, Clermont, Hamilton and Warren are included in these comparisons. No transit emissions are incorporated into any of the reported emission levels. Tables showing emissions and average speed by roadway type, functional class and county are shown in Appendices E-J for the different scenarios.

TABLE I

REGIONAL CONFORMITY FINDINGS

	<u>VMT (million)</u>	<u>VOC (tpd)</u>	<u>NOx (tpd)</u>
1990 BASE YEAR	31.2	143.38	162.95
1997 BASELINE		67.16	118.54
1997 ACTION	34.8	66.98	118.26
2005 BASELINE		47.33	86.51
2005 ACTION	39.1	46.83	86.18
2010 BASELINE		43.80	81.03
2010 ACTION	41.6	42.74	80.00

The ACTION scenarios for 1997, 2005 and 2010 indicate that VOC, and NOx emissions will decrease from the 1990 base year emissions. In addition, the total regional VOC and NOx emissions for the ACTION scenarios decrease from the emissions for the BASELINE scenarios.

In addition, the Ohio counties emissions for ACTION scenarios must be compared to the 15% Plan VOC budget, since Kentucky has requested withdrawal of their 15% Plan. The emissions for the four Ohio counties ACTION scenarios are less than the VOC budget from the 15% Plan as shown in Table II.

TABLE II

OHIO CONFORMITY FINDINGS

	<u>VOC (tpd)</u>
15% Plan Budget	57.23
1997 ACTION	54.17
2005 ACTION	35.97
2010 ACTION	31.87

The OKI Long Range Transportation Plan was amended to comply with financial constraint on April 13, 1995. This Plan also demonstrates conformity with respect to the 1990 base and the 2010 BASELINE scenario. The projects in the 1997-2000 TIP are consistent with the conforming Transportation Plan.

Region-wide emissions of VOC and NOx decrease as a result of the projects contained in OKI's 1997-2000 TIP. No emission increases were demonstrated for any analysis year. Consequently, conformity has been demonstrated for the OKI Fiscal Years 1997-2000 Transportation Improvement Program.